

## Ecological site R048BY237CO Stony Loam

Last updated: 9/07/2023  
Accessed: 05/13/2024

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### General information

**Provisional.** A provisional ecological site description has undergone quality control and quality assurance review. It contains a working state and transition model and enough information to identify the ecological site.

### MLRA notes

Major Land Resource Area (MLRA): 048B–Southern Rocky Mountain Parks and Valleys

This area is in Colorado (96 percent) and Wyoming (4 percent). It makes up about 2,325 square miles (6,020 square kilometers). The town of Walden, in the northern part of this MLRA, is in a wide valley locally known as North Park. The town of Kremmling is in a valley locally known as Middle Park. The town of Hartsel, in the center of the southern part of the MLRA, is in a broad intermontane basin locally known as South Park. The northern part is bordered by the Medicine Bow, Routt, and Arapaho National Forests, and the southern part is bordered by the San Isabel and Pike National Forests. The Arapaho National Wildlife Refuge is directly south of the town of Walden.

This area is within the Southern Rocky Mountains Province of the Rocky Mountain System. It consists of nearly level to rolling mountain parks and valleys and a few narrow mountain ridges. It occurs as two separate parts in the center of the Southern Rockies. The southern half of the northern part is on the west side of the Continental Divide, and the rest of the MLRA is on the east side of the divide. Elevation ranges from 7,850 to 10,850 feet (2,395 to 3,310 meters). The head waters of North Platte River leaves Colorado and enters Wyoming in the northern half of the northern part of the MLRA (North Park). The headwaters of Colorado River is in the southern half of the northern part of the MLRA (Middle Park). The headwaters of South Platte River is in the southern part of the MLRA (South Park).

The mountain valleys and parks that are characteristic of this MLRA are surrounded by high mountain peaks of the adjacent Southern Rocky Mountains MLRA (48A). Steep slopes give rise to steep-gradient streams that can move cobbles and gravel from the mountain slopes down into the valleys. The coarse textured sediments on the surface of this area were deposited by either glacial meltwater or present-day rivers. Buried deep beneath the sediments is a complex of sedimentary and igneous rocks. Residuum from sedimentary rocks is on the steeper slopes that were not covered by alluvium and glacial outwash.

The average annual precipitation is mainly 10 to 16 inches (255 to 405 millimeters), but it is as high as 28 inches (710 millimeters) at the higher elevations that border the Southern Rocky Mountains MLRA. Precipitation generally increases with elevation. Rainfall occurs as high-intensity, convective thunderstorms during the growing season. About half of the annual precipitation falls as snow. Soil moisture is unevenly distributed within short distances because of snowdrifts. The amount of precipitation is highly influenced by rain shadows. The surrounding peaks receive most of the precipitation as storm systems traverse the area. The average annual temperature is 35 to 42 degrees F (1 to 6 degrees C). The freeze-free period averages 95 days and ranges from 70 to 120 days, decreasing in length with elevation.

The dominant soil order in this MLRA is Mollisols. Alfisols are of lesser extent. The soils are very shallow to deep, generally well drained, and loamy or clayey and have mixed or smectitic mineralogy. The soil temperature regime is dominantly cryic, but it is frigid in some small areas, primarily on south- or west-facing slopes. The soil moisture regime is mainly ustic, but a marginal aridic regime has been identified in areas where the average annual precipitation is less than about 12 inches (305 millimeters). The most extensive great group is Argicryolls (Hodden, Lucky, Parlin, Tiagos, and Cabin series), which commonly formed in outwash and slope alluvium on outwash

terraces, fan remnants, hills, and mountain slopes. Haplocryolls (Redcloud and Tealson series) formed in outwash and slope alluvium on outwash terraces, valley side slopes, hills, and ridges. Haplocryalfs (Gebson and Harsha series) formed in slope alluvium and outwash on outwash terraces, fan remnants, hills, ridges, and mountain slopes. Cryaquolls (Dobrow and Randman series) formed in alluvium on stream terraces and flood plains.

## Classification relationships

NRCS:

Major Land Resource Area 48B, Southern Rocky Mountain Parks (United States Department of Agriculture, Natural Resources Conservation Service, 2006).

USFS:

M331I – North Parks and Ranges Section Southern Rocky Mountain Steppe - Open Woodland - Coniferous Forest - Alpine Meadow

EPA:

21i – Sagebrush Parks and 21j – Grassland Parks < 21 Southern Rockies < 6.2 Western Cordillera < 6 Northwestern Forested Mountains North American Deserts (Griffith, 2006).

USGS: Southern Rocky Mountain Province

## Ecological site concept

R048BY237CO Stony Loam occurs on mountain-slopes, ridges, fans and moraines. Slopes is between 20 to 70 percent. Soils are deep to very deep (40 inches or greater) with significant rock within the profile. Soils are derived from till; colluvium from igneous and metamorphic rock; or residuum from igneous and metamorphic rock. Soil surface texture is usually stony loam, cobbly loam, extremely stony sandy loam, gravelly sandy loam, very gravelly sandy loam, or very cobbly sandy loam with loamy-skeletal textured subsurface. It is a bluebunch wheatgrass – needlegrass community with mountain big sagebrush and serviceberry as a shrub component. It has a typic ustic moisture regime. The effective precipitation ranges from 16 to 20 inches.

## Associated sites

R048BY222CO	<p><b>Loamy Park</b> R048BY222CO Loamy Park occurs on flood plains, flood-plain steps, hills, fans and stream terrace. Slopes is between 0 to 15%. Soils are very deep (60+ inches). Soils are derived from alluvium or colluvium. Soil surface texture is usually loam or sandy loam with fine-loamy textured subsurface. It is an Arizona fescue – mountain muhly community.</p>
R048AA228CO	<p><b>Mountain Loam Gunnison Basin LRU</b> R048AY228CO Mountain Loam occurs mainly alluvial fans, mountain slopes, benches, terraces, or hills. Slopes average between 5 and 10% but can range from 0 to 30%. Soils are moderately deep to deep (20-60 inches) loamy soils derived from residuum from igneous and metamorphic rocks or sandstone and shale; slope alluvium from sandstone and shale, or igneous and metamorphic rocks; colluvium from igneous and metamorphic rocks or sandstone and shale, and/or alluvium from igneous and metamorphic rocks. Soil surface texture are loam, sandy loam or silt loam with loamy subsurface. It is a mountain big sagebrush -Arizona fescue community.</p>
R048AY240CO	<p><b>Shallow Pine</b> R048AY240CO Shallow Pine occurs on mountains and mountainsides. Slopes are 5 to 50%. Soils are shallow (10 to 20 inches). Soils are derived from slope alluvium from volcanic breccia, gneiss, granite, or sandstone and/or residuum from granite, granodiorite and/or gneiss. Soil surface texture is a gravelly to very gravelly sandy loam or very gravelly loam with loamy-skeletal subsurface. It is a ponderosa pine - Arizona fescue – mountain muhly community.</p>
R048BY241CO	<p><b>Mountain Meadow</b> R048BY241CO Mountain Meadow occurs on flood plains, stream terraces, drainageways and alluvial flats. Slopes is between 0 to 5%. Soils are moderately deep to very deep (25 to 100 inches). Soils are derived from alluvium from igneous and metamorphic rock. Soil surface texture is usually loam, fine sandy loam, silty clay loam or sandy clay loam with fine-loamy, fine-loamy over sandy-skeletal or coarse-loamy textured subsurface. It is a tufted hairgrass – Nebraska sedge community.</p>

R048BY296CO	<p><b>Claypan</b> R048BY296CO Claypan occurs on hills, ridges, alluvial fans and terraces. Slopes is between 0 to 15%. Soils are moderately deep to deep (20 to 60 inches). Soils are derived from alluvium from sedimentary rock; colluvium from sandstone and shale; residuum from shale; or slope alluvium from sandstone and shale. Soil surface texture is usually loam or clay with fine textured subsurface. It is a little (low) sagebrush – western wheatgrass – pine needlegrass community. It has an aridic ustic moisture regime. The effective precipitation ranges from 12 to 16 inches.</p>
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### Similar sites

R048AY237CO	<p><b>Stony Loam</b> R048AY237CO Stony Loam occurs mainly alluvial fans, mountain slopes mountains and valley sides. Slopes is between 0 to 30%. Soils are deep (60 inches or more) loamy soils derived from outwash; till; colluvium from basalt, sandstone or granite and gneiss; and/or alluvium from igneous and metamorphic rocks; or basalt. Soil surface texture are stony to extremely stony loam, cobbly loam; or cobbly to very cobbly sandy loam with loamy-skeletal subsurface. It is a mountain big sagebrush - bluebunch wheatgrass community.</p>
R048AY311CO	<p><b>Mountain Outwash</b> R048AY311CO Mountain Outwash occurs on fan terraces, alluvial fans, and glacial moraines. Slopes are between 3 to 45%. Soils are deep (60+ inches). Soils are derived from alluvium that is coarse-textured and stony or cobbly. Soil surface texture is gravelly sandy loam or cobbly sandy loam with sandy-skeletal textured subsurface. It is an Arizona fescue – mountain muhly community.</p>
R048AY287CO	<p><b>Stony Foothills</b> R048AY287CO Stony Foothills occurs on mountains, escarpments and hills. Slopes is between 3 to 30%. Soils are moderately deep to deep (20 to 60+ inches). Soils are derived from alluvium, residuum or colluvium from sandstone and shale or alluvium from basalt. Soil surface texture is gravelly, stony, or very stony sandy loam or very cobbly loam with loamy-skeletal textured subsurface. It is a Wyoming big sagebrush – western wheatgrass community. It has an aridic ustic moisture regime and frigid temperature regime. The effective precipitation ranges from 12 to 16 inches.</p>
R048AY316CO	<p><b>Dry Mountain Outwash</b> R048AY316CO Dry Mountain Outwash occurs on fan terraces and alluvial fans. Slopes is between 1 to 45%. Soils are deep (60+ inches). Soils are derived from alluvium or outwash. Soil surface texture is gravelly sandy loam with sandy-skeletal textured subsurface. It is a prairie Junegrass – pine needlegrass community. It has an aridic ustic moisture regime and frigid temperature regime. The effective precipitation ranges from 12 to 16 inches.</p>
R048BY291CO	<p><b>Loamy Glacial Outwash</b> R048BY291CO Loamy Glacial Outwash occurs on fans and terraces. Slopes is between 1 to 45%. Soils are moderately deep to deep (20 to 60 inches). Soils are derived from outwash. Soil surface texture is usually very cobbly sandy loam, extremely cobbly sandy loam, very gravelly sandy loam or gravelly loam with loamy-skeletal textured subsurface. It is a Gambel oak – Arizona fescue – muttongrass community. It has a typic ustic moisture regime. The effective precipitation ranges from 14 to 18 inches.</p>
R048AY377CO	<p><b>Skeletal Loam</b> R048BY377CO Skeletal Loam occurs on hills, mountains, mountainsides, fan terraces, pediments, outwash terrace and mesas. Slopes is between 5 to 55%. Soils are deep to very deep (40 to 60+ inches). Soils are derived from slope alluvium from conglomerate, sandstone, trachyte, or volcanic breccia; outwash; colluvium from volcanic rock, trachyte, or volcanic breccia or residuum from volcanic rock. Soil surface texture is usually very gravelly loam. gravelly loam, very cobbly loam or very gravelly sandy loam with loamy-skeletal or clayey skeletal textured subsurface. It is an Arizona fescue – Parry's oatgrass community. It has an aridic ustic moisture regime. The effective precipitation ranges from 14 to 16 inches.</p>

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) <i>Amelanchier alnifolia</i> (2) <i>Artemisia tridentata ssp. vaseyana</i>
Herbaceous	(1) <i>Pseudoroegneria spicata</i> (2) <i>Achnatherum</i>

### Physiographic features

Stony hills and mountain sides are typical of the landscape of this range site. Slopes are from steep to very steep (20 to 70 percent). Elevations range between 7600 and 9200 feet.

**Table 2. Representative physiographic features**

Landforms	(1) Mountain slope (2) Fan (3) Ridge (4) Moraine
Runoff class	Medium to high
Flooding frequency	None
Ponding frequency	None
Elevation	2,316–2,804 m
Slope	20–70%
Aspect	Aspect is not a significant factor

### Climatic features

Average annual precipitation is about 16 to 20 inches. Of this, approximately 60 to 70 percent falls as snow, and 30 to 40 percent falls as rain between middle of June to and the end of September. Summer moisture is mostly from thundershowers in June thru September. October, November, February, and March are the driest periods of the year with the driest month being October. April, May, July, and August is the wettest periods; and the wettest month is usually August.

The average annual total snowfall is 137.9 inches. The snow depth usually ranges from 1 to 24 inches during October thru May. The highest winter snowfall record in this area is 228.80 inches which occurred in 1961-1962. The lowest snowfall record is 57.8 inches during the 1980-1981 winter.

The frost-free period typically ranges from 12 to 65 days. The last spring frost is typically the end of June to the end of July. The first fall frost is usually the end of July to the end of August.

Mean daily annual air temperature ranges from about 20.1 degrees F to 52.9 degrees F, averaging about 18.2 degrees F for the winter and 54.9 degrees F in the summer. Summer high temperatures of low-70 degrees F to mid-70 degrees F are not unusual. The coldest winter temperature recorded was -43 degrees F on January 13, 1963 and the warmest winter temperature recorded was 56 degrees F on February 26, 1950. The coldest summer temperature recorded was 16 degrees F on June 26, 1978 and the warmest was 92 degrees F on July 15, 1978.

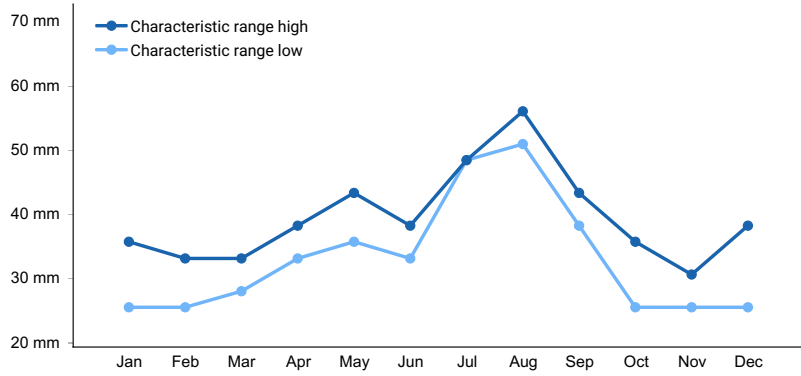
Wide yearly and seasonal fluctuations are common for this climatic zone. Data taken from Western Regional Climate Center (2018) for Grand Lake 1 NW, Colorado Climate Station.

This zone in MLRA 48B will need to be broken up into at multiple land resources zones in future projects based on current knowledge of precipitation and temperature patterns based on North Park-Middle Park and South Park. There are only 2 climate stations in this LRU climatic zone and they are both in middle park (Grand Lake 1 NW and Dillion 1 E). Grand Lake is on the high end of precipitation and Dillion is on the lower end.

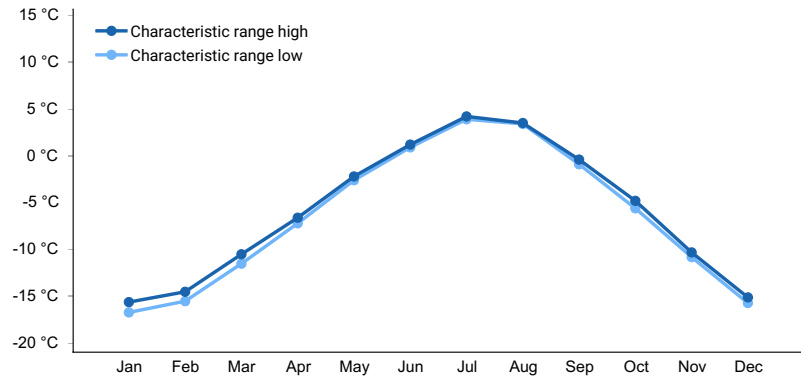
**Table 3. Representative climatic features**

Frost-free period (characteristic range)	12-13 days
Freeze-free period (characteristic range)	55 days
Precipitation total (characteristic range)	406-483 mm
Frost-free period (actual range)	12-13 days
Freeze-free period (actual range)	55-65 days
Precipitation total (actual range)	406-508 mm

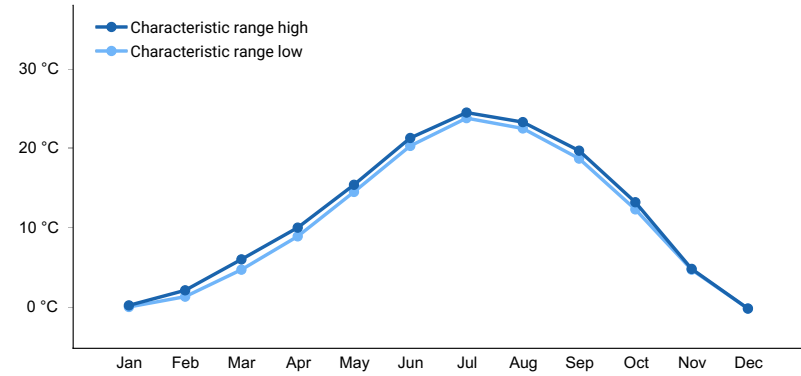
Frost-free period (average)	13 days
Freeze-free period (average)	55 days
Precipitation total (average)	432 mm



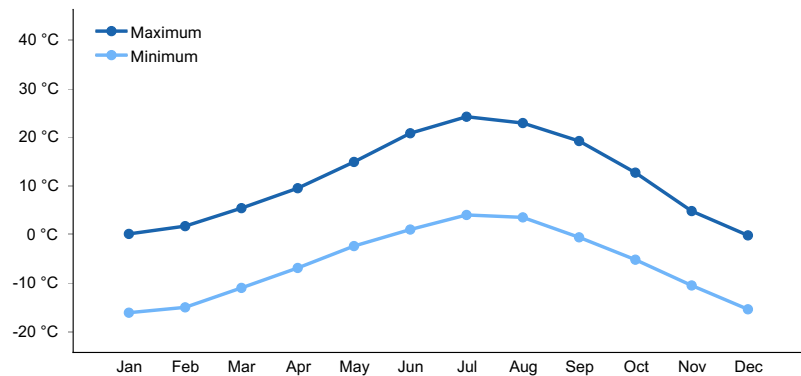
**Figure 1. Monthly precipitation range**



**Figure 2. Monthly minimum temperature range**



**Figure 3. Monthly maximum temperature range**



**Figure 4. Monthly average minimum and maximum temperature**

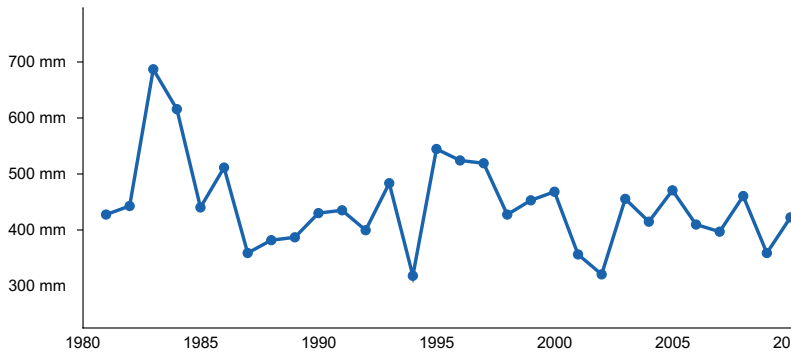


Figure 5. Annual precipitation pattern

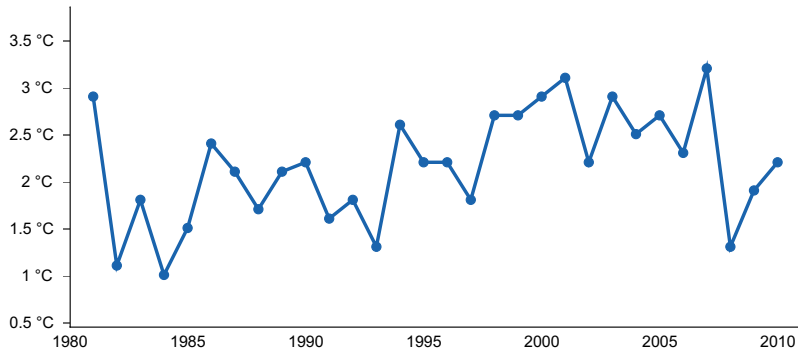


Figure 6. Annual average temperature pattern

### Climate stations used

- (1) DILLON 1 E [USC00052281], Dillon, CO
- (2) GRAND LAKE 1 NW [USC00053496], Grand Lake, CO

### Influencing water features

None.

### Wetland description

N/A

### Soil features

Deep to very deep stone-filled heavy sandy loam to clay loam, very dark brown in color. Permeability is moderate; but water holding capacity is reduced due to stone dilution. The profile is usually non-calcareous throughout. The surface is frequently stony. Soil-plant-water relationships are fair to good. The abundance of stones in the profile acts to make soil water more readily available for plant use in a given volume of soil.

Table 4. Representative soil features

Parent material	(1) Colluvium (2) Till (3) Colluvium–igneous and metamorphic rock (4) Residuum–igneous and metamorphic rock
Surface texture	(1) Stony, cobbly loam (2) Extremely stony, gravelly, very gravelly sandy loam (3) Very cobbly sandy loam
Family particle size	(1) Loamy-skeletal
Permeability class	Moderate to moderately rapid

Soil depth	152 cm
Surface fragment cover <=3"	10–30%
Surface fragment cover >3"	10–50%
Available water capacity (Depth not specified)	5.08–12.7 cm
Soil reaction (1:1 water) (Depth not specified)	6.1–7.8
Subsurface fragment volume <=3" (Depth not specified)	20–35%
Subsurface fragment volume >3" (Depth not specified)	10–55%

## Ecological dynamics

Saskatoon serviceberry, antelope bitterbrush, big sagebrush, mountain snowberry, and Douglas rabbitbrush give this site the appearance of a shrub plant community. Grasses and forbs, however, comprise a significant percentage of the annual yield. Bluebunch wheatgrass, Idaho or Arizona fescue, muttongrass, Indian ricegrass, needle and thread, and other needlegrasses (pine needlegrass, Letterman's needlegrass, Scribner needlegrass, and Columbia needlegrass), prairie Junegrass, western wheatgrass, spike fescue along with sedges are frequent in occurrence. Forbs of this site are tapertip hawksbeard, hollyleaf clover, arrowleaf balsamroot, paintbrush, pussytoes, stonecrop, and geranium.

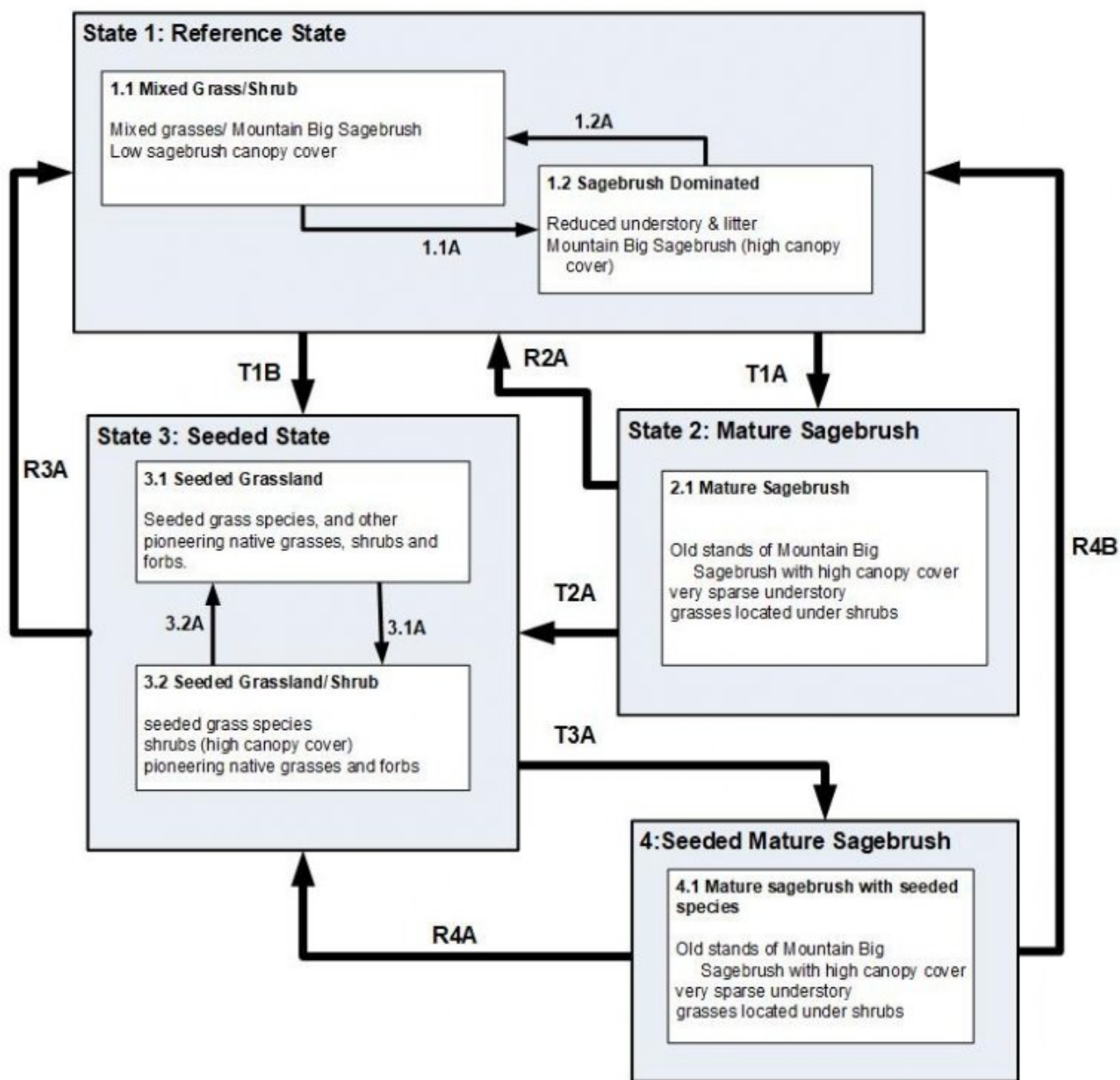
In general this site is devoid of trees but a lone pine, Douglas-fir, Rocky Mountain juniper, or aspen may grow on a soil inclusion associated with the site.

Much of the land surface is occupied by stones but the spaces between them are well filled with plant cover. Plants not a part of the community that are likely to invade when the cover deteriorates are cluster tarweed, hound's tongue, Canada thistle, cheatgrass, stickseed, knotweed, and other similar species.

Favorable years 2000 pounds per acre  
Median years 1200 pounds per acre  
Unfavorable years 1000 pounds per acre

## State and transition model

## R048BY237CO Stony Loam



## Legend

1.1A, 3.1A, T1A, T3A – Extended improper grazing, lack of fire, extended drought, time without disturbance, and/or lack of insect/pathogen outbreaks

1.2A, 3.2A – Fire, proper grazing, wet climatic cycles, vegetative treatments, and/or small scale insect/pathogen outbreaks

T1B, T2A – Seeded herbaceous species planted and/or shrub removal

R2A – fire, vegetation treatments, insect herbivory, drought, proper grazing, and/or encroached shrub removal

R3A, R4B – intensive management and inputs maybe required to return to reference state, wet climatic years, native plantings, vegetative treatments, proper grazing and/or fire

R4A – Fire, proper grazing, wet climatic cycles, small scale insect/pathogen outbreaks and/or seeding, vegetative treatments



**State 1**  
**Reference State**

**Community 1.1**  
**Reference State**

The approximate ground cover of the potential plant community is 30 percent.

**Table 5. Annual production by plant type**

<b>Plant Type</b>	<b>Low (Kg/Hectare)</b>	<b>Representative Value (Kg/Hectare)</b>	<b>High (Kg/Hectare)</b>
Grass/Grasslike	863	874	1541
Tree	196	303	420
Forb	62	168	280
<b>Total</b>	<b>1121</b>	<b>1345</b>	<b>2241</b>

**Additional community tables**

**Table 6. Community 1.1 plant community composition**

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
<b>Grass/Grasslike</b>					
1	<b>Grasses</b>			673–1076	
	bluebunch wheatgrass	PSSP6	<i>Pseudoroegneria spicata</i>	135–269	–
	Indian ricegrass	ACHY	<i>Achnatherum hymenoides</i>	67–202	–
	needle and thread	HECOC8	<i>Hesperostipa comata</i> ssp. <i>comata</i>	67–202	–
	Arizona fescue	FEAR2	<i>Festuca arizonica</i>	67–135	–
	Idaho fescue	FEID	<i>Festuca idahoensis</i>	67–135	–
	Letterman's needlegrass	ACLE9	<i>Achnatherum lettermanii</i>	67–135	–
	western wheatgrass	PASM	<i>Pascopyrum smithii</i>	67–135	–
	muttongrass	POFE	<i>Poa fendleriana</i>	67–135	–
	Columbia needlegrass	ACNE9	<i>Achnatherum nelsonii</i>	27–67	–
	pine needlegrass	ACPI2	<i>Achnatherum pinetorum</i>	27–67	–
	prairie Junegrass	KOMA	<i>Koeleria macrantha</i>	27–67	–
<b>Forb</b>					
2	<b>Forbs</b>			67–269	
	pussytoes	ANTEN	<i>Antennaria</i>	27–135	–
	arrowleaf balsamroot	BASA3	<i>Balsamorhiza sagittata</i>	27–135	–
	Indian paintbrush	CASTI2	<i>Castilleja</i>	27–135	–
	tapertip hawksbeard	CRAC2	<i>Crepis acuminata</i>	27–135	–
	buckwheat	ERIOG	<i>Eriogonum</i>	27–135	–
	geranium	GERAN	<i>Geranium</i>	27–135	–
	stonecrop	HYLOT	<i>Hylotelephium</i>	27–135	–
	phlox	PHLOX	<i>Phlox</i>	27–135	–
	hollyleaf clover	TRGY	<i>Trifolium gymnocarpon</i>	27–135	–
<b>Shrub/Vine</b>					
3	<b>Shrubs</b>			202–404	
	Saskatoon serviceberry	AMAL2	<i>Amelanchier alnifolia</i>	67–202	–
	mountain big sagebrush	ARTRV	<i>Artemisia tridentata</i> ssp. <i>vaseyana</i>	67–135	–
	antelope bitterbrush	PUTR2	<i>Purshia tridentata</i>	40–67	–
	mountain snowberry	SYOR2	<i>Symphoricarpos oreophilus</i>	40–67	–

## Other references

Chapman, S.S., G.E. Griffith, J.M. Omernik, A.B. Price, J. Freeouf, and D.L. Schrupp. 2006. Ecoregions of Colorado. (2-sided color poster with map, descriptive text, summary tables, and photographs). U.S. Geological Survey, Reston, VA. Scale 1:1,200,000.

Cleland, D.T.; Freeouf, J.A.; Keys, J.E.; Nowacki, G.J.; Carpenter, C.A.; and McNab, W.H. 2007. Ecological Subregions: Sections and Subsections for the conterminous United States. Gen. Tech. Report WO-76D [Map on CD-ROM] (A.M. Sloan, cartographer). Washington, DC: U.S. Department of Agriculture, Forest Service, presentation scale 1:3,500,000; colored.

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## Contributors

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## Approval

Kirt Walstad, 9/07/2023

## Acknowledgments

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Those involved in developing earlier versions of this site description include: Bob Rayer, retired NRCS Soil Scientist; Herman Garcia, retired CO State RMS and NRCS MLRA Ecological Site Specialist-QA Phoenix, AZ.

--Site Development and Testing Plan--:

Future work to validate and further refine the information in this Provisional Ecological Site Description is necessary. This will include field activities to collect low-, medium-, and high-intensity sampling, soil correlations, and analysis of that data.

Additional information and data is required to refine the Plant Production and Annual Production tables for this ecological site. The extent of MLRA 48A must be further investigated.

Field testing of the information contained in this Provisional ESD is required. As this ESD is moved to the Approved ESD level, reviews from the technical team, quality control, quality assurance, and peers will be conducted.

## Rangeland health reference sheet

Interpreting Indicators of Rangeland Health is a qualitative assessment protocol used to determine ecosystem condition based on benchmark characteristics described in the Reference Sheet. A suite of 17 (or more) indicators are typically considered in an assessment. The ecological site(s) representative of an assessment location must be known prior to applying the protocol and must be verified based on soils and climate. Current plant community cannot be used to identify the ecological site.

Author(s)/participant(s)	
Contact for lead author	

Date	05/13/2024
Approved by	Kirt Walstad
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

## Indicators

1. **Number and extent of rills:**

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2. **Presence of water flow patterns:**

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3. **Number and height of erosional pedestals or terracettes:**

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4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):**

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5. **Number of gullies and erosion associated with gullies:**

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6. **Extent of wind scoured, blowouts and/or depositional areas:**

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7. **Amount of litter movement (describe size and distance expected to travel):**

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8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):**

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9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):**

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10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:**

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11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):**

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12. **Functional/Structural Groups (list in order of descending dominance by above-ground annual-production or live foliar cover using symbols: >>, >, = to indicate much greater than, greater than, and equal to):**

Dominant:

Sub-dominant:

Other:

Additional:

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13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):**
- 

14. **Average percent litter cover (%) and depth ( in):**
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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):**
- 

16. **Potential invasive (including noxious) species (native and non-native). List species which BOTH characterize degraded states and have the potential to become a dominant or co-dominant species on the ecological site if their future establishment and growth is not actively controlled by management interventions. Species that become dominant for only one to several years (e.g., short-term response to drought or wildfire) are not invasive plants. Note that unlike other indicators, we are describing what is NOT expected in the reference state for the ecological site:**
- 

17. **Perennial plant reproductive capability:**
-